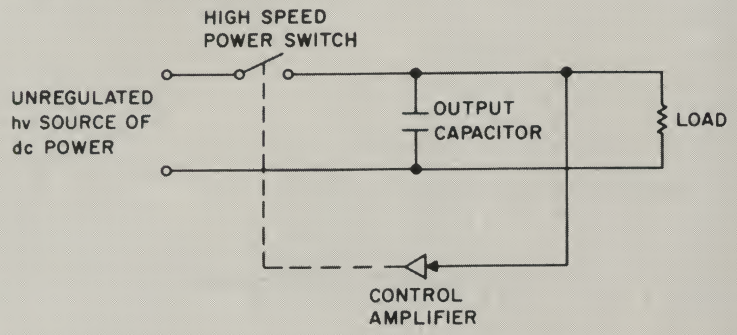
THE OMNIMOD CONCEPT

OMNIMOD is a new concept involving a new electronic regulation technique and unique new packaging philosophy. This new concept now makes it possible and practical to build most custom power supply systems simply, quickly, and inexpensively with little more effort than assembling plug-in modules. The resulting power supply is small in size and can meet nearly any special custom specification requirements.

OMNIMOD REGULATION TECHNIQUE

The basic OMNIMOD regulation technique can be understood through use of this schematic diagram:



Power to the load is supplied from energy stored in the output capacitor. Whenever the output voltage is at, or slightly above the desired level, the power switch is open. When the load draws enough energy out of the output capacitor to reduce the voltage across it to a level slightly below that desired, the control amplifier turns on the power switch. Unlike pulse width modulation switching regulator schemes, the switch stays on for a fixed period. During this "on time", energy is transferred from the source to the output capacitor, recharging it to a voltage level slightly above the desired level. In this way the switch operates in a constant pulse width, variable repetition rate mode to regulate the output voltage near the desired level.

The device will operate over a very wide range of output voltage levels from just one source of input voltage, since it transfers energy in pulses from input to the output capacitor.

If a full load step is applied to this supply, the switch will begin running at a repetition rate high enough to supply full load current before the load can discharge the capacitor to a voltage level outside the regulation band. The supply will therefore not go out of the regulation band on application or removal of full load steps.

There is a maximum repetition rate at which the device can run. This maximum rate determines the maximum output current that the device is capable of supplying, even into a short circuit. The supply will not be damaged by operating at this maximum current rate for long periods of time.

SEE BACK PAGE FOR LIST OF AVAILABLE MODULES

DATA SHEET 101/ 9-66

OMNIMOD POWER SUPPLY

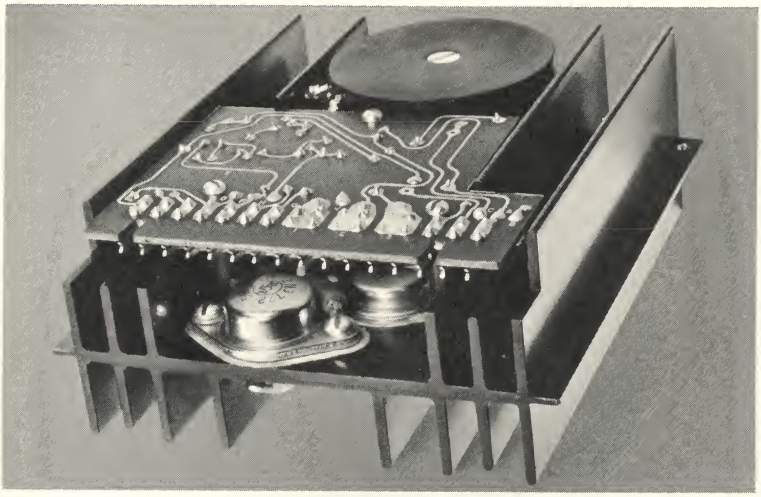
CONTEMPORARY ELECTRONICS

EXTRA SERVICE

PACKAGING PHILOSPHY

OMNIMOD utilizes three basic building blocks: power control modules, control amplifiers and filter capacitors. These units are compatible in size for easy packaging.

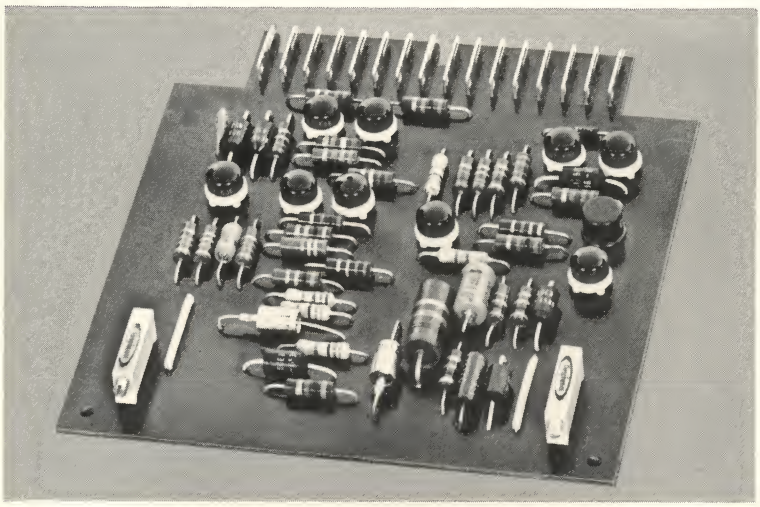
POWER CONTROL MODULE



The OMNIMOD power control module is a constant pulse width, variable repetition rate, chopper type, dc to dc converter. It is constructed on a section of extruded aluminum heat sink and may be plugged into a standard connector. Different modules are used for + and — voltage outputs.

Power control modules may be connected in parallel for higher current output.

CONTROL AMPLIFIER



The OMNIMOD control amplifier is a plug-in printed circuit board used to determine the level to which the power control modules regulate power. Different amplifiers are used to operate + and — power control modules. One control amplifier will control an unlimited number of power control modules connected in parallel. Built-in overvoltage sensing circuitry is provided which controls an external crowbar SCR to protect external circuitry in the event of a failure of any kind which otherwise might cause lack of control over the output level.

FEATURES

EASY MAINTENANCE

Should a power supply failure occur, the problem is easily located with minimum equipment. In most instances, repair is simply the replacement of a module. This reduces power supply down-time to an absolute minimum. Units are interchangeable. This means fewer parts need be in stock for a major D.P. system. The field repairman need not actually understand the circuit to maintain it.

ADD-ON CAPABILITY

If a system is produced which requires a larger than normal power supply system, more modules are used. Only minimal new design and evaluation effort is required, and no additional field support is needed. For variable size machines, only the required number of modules need be plugged in.

IMPROVED MACHINE PACKAGING

Because of modular construction, the power regulation elements can be distributed throughout the electronic circuit sections of the machine. The power converter section is centrally located, common to all power control modules and occupies only part of the volume normally used by power supplies. This makes overall machine packaging easier and eliminates many power distribution problems.

LOW COST

Because standard modules are produced in volume and are used for every purpose, initial design, manual preparation, and production costs are low.

EXCELLENT TRANSIENT REGULATION

The power supply will tolerate zero-to-full-load, or full-load-to-zero current steps and maintain the output voltage within a few millivolts of the regulation level.

LINE LOADING

OMNIMOD presents a load to the line that is between 0.9 lagging and unity power factor. OMNIMOD will load all three phases of a 3 phase line within 5%. OMNIMOD is not power line frequency sensitive.

DELIVERY

Because OMNIMOD is manufactured and stocked in volume, delivery lead time is shortened. New customer design prototypes, including input power converter and instruction manual, can usually be supplied in 6 to 8 weeks after receipt of order.

POWER SUPPLY PROTECTION

The power supply cannot be damaged by short circuit or open circuit load.

LOAD PROTECTION

The power supply cannot reverse voltage output even if shorted to a higher voltage source of opposite polarity.

Overvoltage protection is provided which prevents the output from exceeding any preset level.

Undervoltage protection may be added easily.

REMOTE CONTROL

Remote voltage level adjustment and voltage level switching for margin checking can be easily added.

Output voltage levels can be automatically varied from preset levels according to the temperature at any point such as internal memory stack temperature. Output level may be controlled at any point in the load.

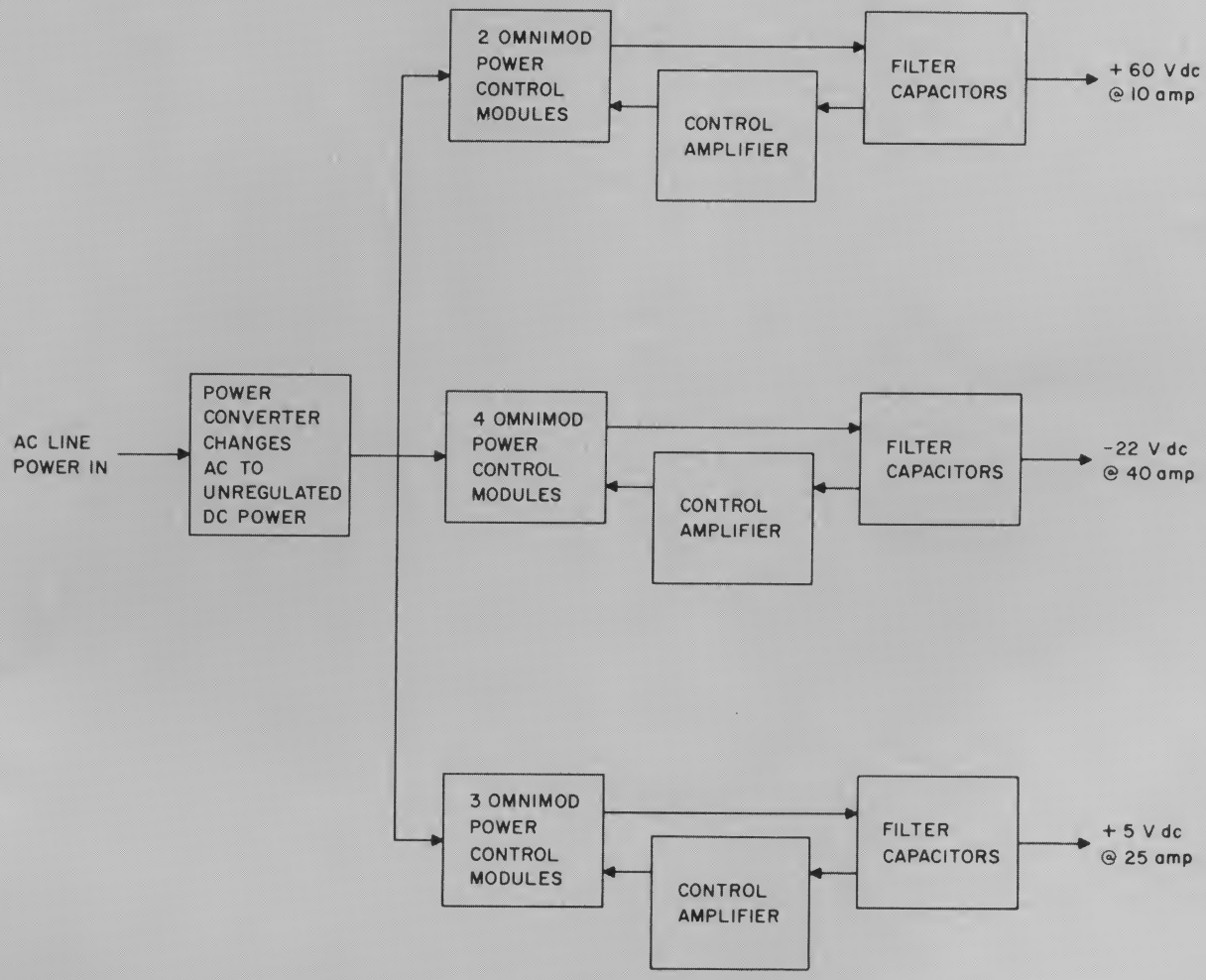
OUTPUT SEQUENCING

On and off sequencing of outputs in a large system can be provided by the addition of one printed circuit board per power supply.

HOW A CUSTOM POWER SUPPLY IS ASSEMBLED WITH OMNIMOD MODULES

90% of all custom power supplies using the OMNIMOD concept cost less, can be assembled in less time and offer performance advantages. The following example shows how a custom power supply could be constructed using OMNIMOD modules.

Assume that a custom requirement calls for a power supply having three outputs; +60v dc at 10 amperes, −22v dc at 40 amperes and +5v dc at 25 amperes. The block diagram shows how such a supply could be assembled with plug-in OMNIMOD modules.



The amount of filter capacitance used depends upon the ripple requirements of the load.

Most of the custom instruction and maintenance manual for this custom power supply would be assembled from preprinted sheets.

Because only a small amount of engineering is required, prototype custom power supplies using OMNIMOD can be delivered in a short time and at low cost. Production quantity prices are also very competitive.

Contemporary Electronics engineering staff will design a custom power supply using OMNIMOD to meet your specification or we will help you design your own supply using "off the shelf" modules. Write for Application Note 600* which will help you design your own OMNIMOD custom power supply and which shows many typical uses of OMNIMOD modules to solve actual power supply problems.

*Price $2.50 per copy

SEE BACK PAGE FOR LIST OF AVAILABLE MODULES

AVAILABLE MODULES

A family of OMNIMOD switching type power control modules is available for both plus and minus outputs. In addition, series transistor regulator modules for low current requirements are also available. All of these modules plus the control amplifiers and the data sheets describing these modules are listed in the following table.

Model No.	Voltage Range Volts DC	Maximum Current Range Amperes DC	Data Sheet No.
100-1200	+2 to +36	0 to 10	104
100-1100	−2 to −36	0 to 10	104
100-1400	+2 to +60	0 to 7	105
100-1300	−2 to −60	0 to 7	105
190-1600	+Control Amplifier	—	107
190-1700	−Control Amplifier	—	107

Write or CALL COLLECT when you are interested to see what OMNIMOD can do for your system.

WE'D LIKE TO HEAR FROM YOU— WE'RE ANXIOUS TO PLUG SOME INTO YOUR SYSTEM!

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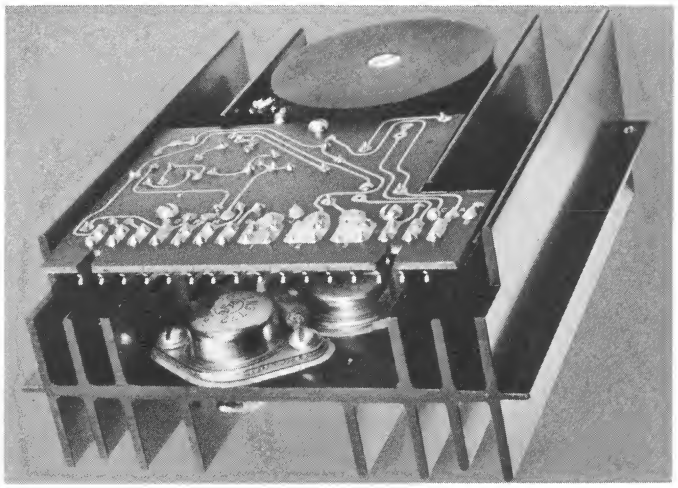
OMNIMOD

POWER CONTROL MODULES

MODULES 100-1100

100-1200



Data sheet 101 describes the OMNIMOD concept and application and note 600 shows how to use OMNIMOD in the construction of custom power supplies. This data sheet describes OMNIMOD power control module, models 110-1100 and 100-1200. Both of these modules utilize silicon switching transistors to control output power. Following are specifications for these modules:

OUTPUT VOLTAGE

Any output voltage from 2 to 36v dc may be obtained from these power control modules. The 100-1100 delivers minus voltage with respect to ground, and the 100-1200 is designed for the "plus" group. The 100-1100 power control modules require a 190-1700 control amplifier and the 100-1200 power control modules require a 190-1600 control amplifier.

EFFICIENCY

Typical efficiency of these power control modules is 90% at 30 volts dc output, full load and nominal line voltage. Efficiency will be higher than 90% at output voltages above 30 volts and less than 90% at voltages below 30 volts. These figures neglect the efficiency of the power converter section and amplifier.

LINE ISOLATION

Line isolation is provided through the input power converter which may be located some distance from the OMNIMOD power controller modules.

TEMPERATURE RANGE

See rating charts below.

REGULATION

Combined line and load regulation is 0.02% or 45 mv whichever is greater.

TRANSIENT RESPONSE

Peak excursion of output voltage during no-load-to-full-load steps is no greater than two times the regulation band.

RIPPLE

Ripple level is determined by the amount of output filter capacitance used. With one aluminum electrolytic capacitor, typical peak to peak ripple is 1% at the 30v level.

SIZE

See reverse side

CONNECTIONS

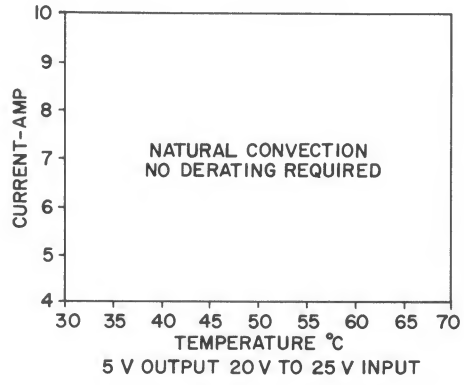
See reverse side

OVERCURRENT PROTECTION

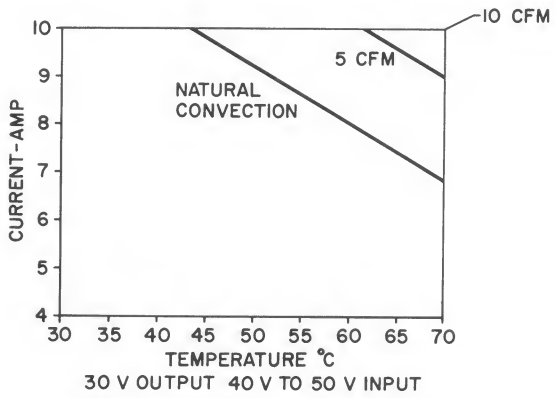
These modules cannot be damaged by overload or short circuit loads, even if the fault remains for long periods of time.

OUTPUT CURRENT RATINGS

These rating charts show maximum output current at various temperatures and output voltage levels with and without forced air cooling. The ratings are based on a generous derating of all components used in the modules, and are therefore safe ratings for continuous duty.



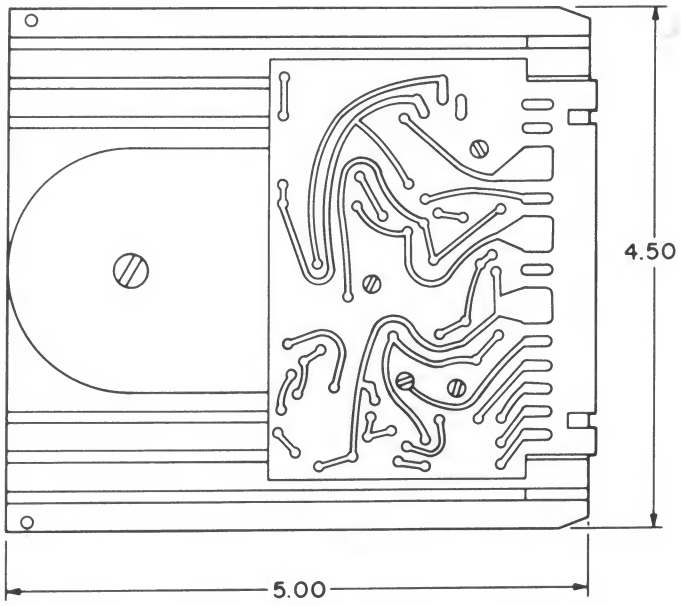
5 V OUTPUT 20 V TO 25 V INPUT

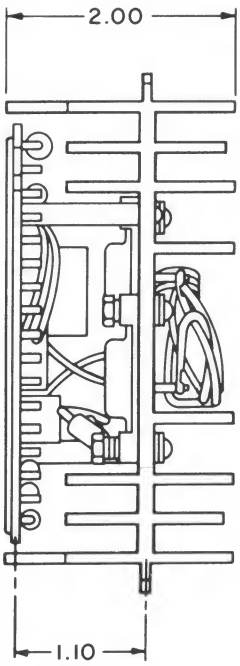


30 V OUTPUT 40 V TO 50 V INPUT

CONTINUED ON OTHER SIDE

OUTLINE DIMENSIONS





INPUT VOLTAGE

The maximum instantaneous value of input dc voltage level is 55 volts. The minimum instantaneous input voltage level is 10 volts dc above the desired regulated output voltage level. A 5-volt dc minimum voltage difference between input and output is possible under special conditions.

CONNECTOR AND MOUNTING INFORMATION

The modules are designed to mount in a chassis using standard printed circuit board guides. The mating connector for both of these power control modules is Elco, model number 00-5006-015-189-005. The modules are keyed with Elco style A inserts.

For the minus control module (100-1100) the inserts are located between pins 1 and 2 and 14 and 15.

For the plus control module (100-1200) the inserts are located between pins 1 and 2 and 13 and 14.

The value of the resistor connected between pins five and eleven is selected to provide a current flow of 350 ma minimum between these pins.

EXTERNAL CONNECTIONS TO POWER CONTROL MODULES

Connector pin number	Connection
1	current sensor output to pin 5 of control amplifier
2	—22v dc
3	drive from pin 3 of control amplifier
4	+22v dc
5	external resistor to pin 11
6, 7	common
8	not used
9, 10	input dc power through a fuse
11	external resistor to pin 5
12, 13	output
14	not used
15	end of pulse sensor to pin 7 of control amplifier

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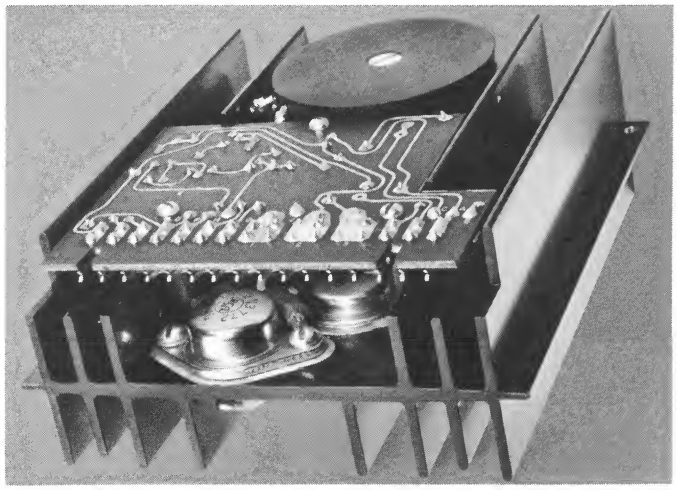
OMNIMOD

POWER CONTROL MODULES

MODULES 100-1300

100-1400



Data sheet 101 describes the OMNIMOD concept and application and note 600 shows how to use OMNIMOD in the construction of custom power supplies. This data sheet describes OMNIMOD power control module, models 100-1300 and 100-1400. Following are specifications for these modules:

OUTPUT VOLTAGE

Any output voltage from 2 to 60v dc may be obtained from these power control modules. The 100-1300 delivers minus voltage with respect to ground, and the 100-1400 is designed for the "plus" group. The 100-1300 power control modules require a 190-1700 control amplifier and the 100-1400 power control modules require a 190-1600 control amplifier.

EFFICIENCY

Typical efficiency of these power control modules is 90% at 30 volts dc output, full load and nominal line voltage. Efficiency will be higher than 90% at output voltages above 30 volts and less than 90% at voltages below 30 volts. These figures neglect the efficiency of the power converter section and amplifier.

LINE ISOLATION

Line isolation is provided through the input power converter which may be located some distance from the OMNIMOD power controller modules.

TEMPERATURE RANGE

See rating charts below.

REGULATION

Combined line and load regulation is 0.02% or 45 mv whichever is greater.

TRANSIENT RESPONSE

Peak excursion of output voltage during no-load-to-full-load steps is no greater than two times the regulation band.

RIPPLE

Ripple level is determined by the amount of output filter capacitance used. With one aluminum electrolytic capacitor, typical peak to peak ripple is 1% at the 30v level.

SIZE

See reverse side

CONNECTIONS

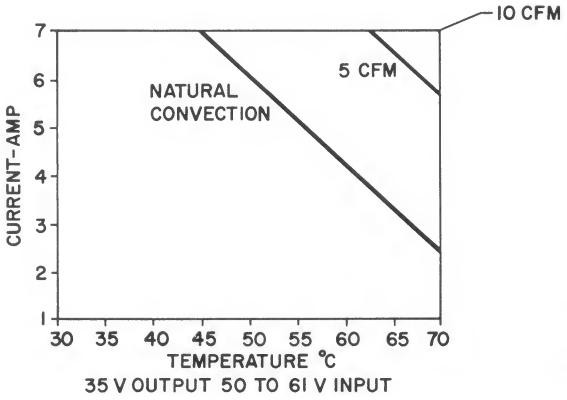
See reverse side

OVERCURRENT PROTECTION

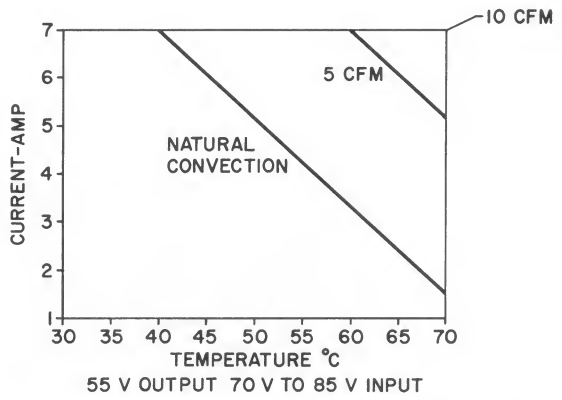
These modules cannot be damaged by overload or short circuit loads, even if the fault remains for long periods of time.

OUTPUT CURRENT RATINGS

These rating charts show maximum output current at various temperatures and output voltage levels with and without forced air cooling. The ratings are based on a generous derating of all components used in the modules, and are therefore safe ratings for continuous duty.



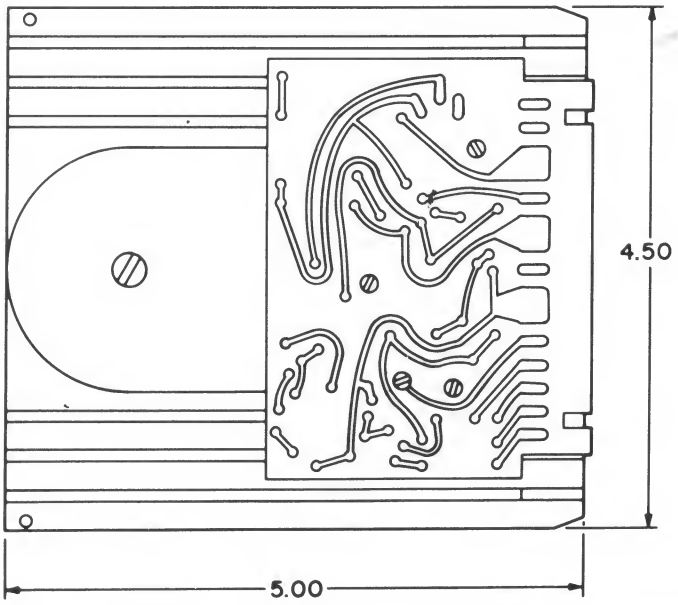
35 V OUTPUT 50 TO 61 V INPUT

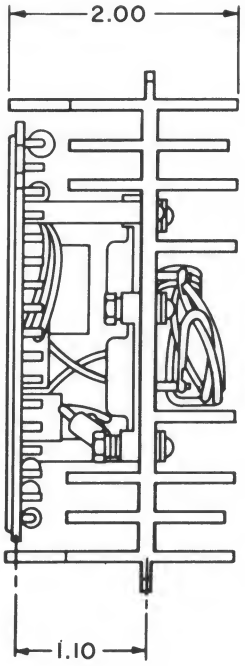


55 V OUTPUT 70 V TO 85 V INPUT

CONTINUED ON OTHER SIDE

OUTLINE DIMENSIONS





INPUT VOLTAGE

The maximum instantaneous value of input dc voltage level is 110 volts. The minimum instantaneous input voltage level is 10 volts dc above the desired regulated output voltage level. A 5-volt dc minimum voltage difference between input and output is possible under special conditions.

CONNECTOR AND MOUNTING INFORMATION

The modules are designed to mount in a chassis using standard printed circuit board guides. The mating connector for both of these power control modules is Elco, model number 00-5006-015-189-005. The modules are keyed with Elco style A inserts.

For the minus control module (100-1300) the inserts are located between pins 1 and 2 and 12 and 13.

For the plus control module (100-1400) the inserts are located between pins 1 and 2 and 11 and 12.

The value of the resistor connected between pins five and eleven is selected to provide a current flow of 265 ma minimum between these pins.

EXTERNAL CONNECTIONS TO POWER CONTROL MODULES

Connector pin number	Connection
1	current sensor output to pin 5 of control amplifier
2	−22v dc
3	drive from pin 3 of control amplifier
4	+22v dc
5	external resistor to pin 11
6, 7	common
8	not used
9, 10	input dc power through a fuse
11	external resistor to pin 5
12, 13	output
14	not used
15	end of pulse sensor to pin 7 of control amplifier

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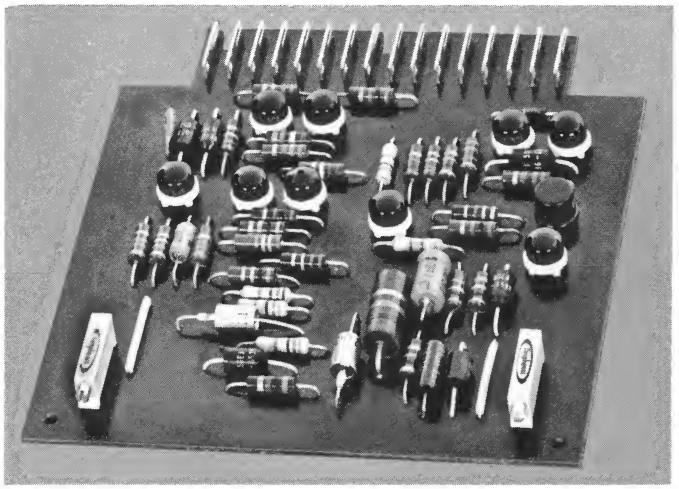
OMNIMOD

CONTROL AMPLIFIERS

MODELS 190-1600

190-1700



Data sheet 101 describes the OMNIMOD concept and application note 600 shows how to use OMNIMOD in construction of custom power supplies. This data sheet describes OMNIMOD control amplifier models 190-1600 and 190-1700. The 190-1600 amplifier will control any of the "plus" power control modules and the 190-1700 amplifier is designed for the "minus" group. Either amplifier will control up to five power control modules. With an additional booster card, the amplifiers will drive an indefinite number of power control modules. Following are specifications describing these control amplifiers:

TEMPERATURE RANGE

The amplifiers will operate over an ambient temperature range of 0 to 70°C convection cooled.

OVERVOLTAGE PROTECTION

The control amplifiers have overvoltage protection circuitry which controls an external crowbar SCR across the output of the power control modules. This protection circuitry is entirely independent of the control circuit, and has its own reference voltage.

PROGRAMMING

The power control output voltage level can be programmed by impedance change by: (1) an external adjustment potentiometer or (2) a variable impedance such as a sensistor which will vary output level versus temperature at some point, for example, a memory stack.

INPUT

The amplifiers require plus and minus 22v dc for operation. For the 190-1600 models, the power needed is +22v dc @ 60 to 200 ma depending on the number of power control modules being driven and −22v dc @ 35 ma.

The 190-1700 amplifier needs +22v dc @ 35 ma and −22v dc @ 60 to 200 ma depending on the number of power control modules being driven. The voltages should be regulated to ± 2%. A zener diode regulator is entirely adequate. Contemporary Electronics engineering department will supply a circuit for supplying power to the amplifiers.

SIZE

See other side of this sheet for dimensions.

QUALITY MATERIALS

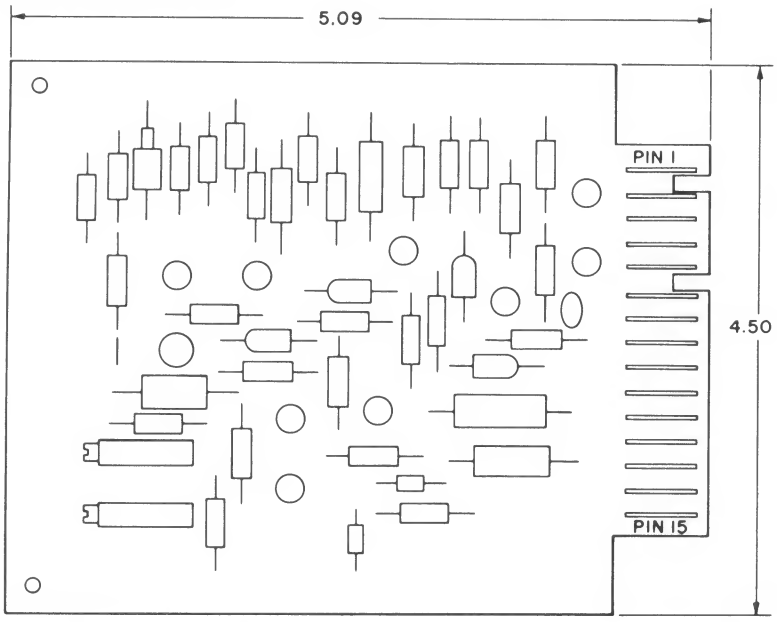
The amplifiers are constructed with G-10 fibre glass epoxy printed circuit board stock with 2 ounce copper.

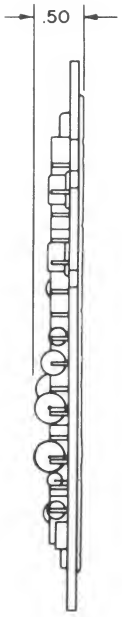
REMOTE SENSING

Voltage may be controlled at any point in the load through a pair of twisted leads.

CONTINUED ON OTHER SIDE

OUTLINE DIMENSIONS





CONNECTOR AND MOUNTING INFORMATION

The amplifiers are designed to mount in a chassis using standard printed circuit board guides. The mating connector for both of these OMNIMOD control amplifiers is Elco, model number 00-5006-015-189-005. The modules are keyed with Elco style A inserts.

For the minus control amplifier(190-1700)the inserts are located between pins 1 and 2 and 5 and 6.

For the plus control amplifier(190-1600)the inserts are located between pins 1 and 2 and 3 and 4.

EXTERNAL CONNECTIONS TO CONTROL AMPLIFIERS

Connector pin number	Connection
1	Remote ground
2	−22v dc
3	Output to power control module pin 3
4	+22v dc
5	Power control module current sensor pin 1
6	Common
7	Power control module end pulse sensor pin 15
8	Output dc
9	Input dc through a resistor
10	Drive signal to the crowbar SCR
11	Remote sense through a resistor
12	Output dc through a resistor
13, 14	Used for external programming with temperature
15	Undervoltage reference

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POWER SUPPLIES

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OMNIMOD POWER SUPPLY CONCEPT

TRANSISTOR BASE RESISTANCE — EFFECT ON HIGH SPEED SWITCHING

ANNUAL INDEX

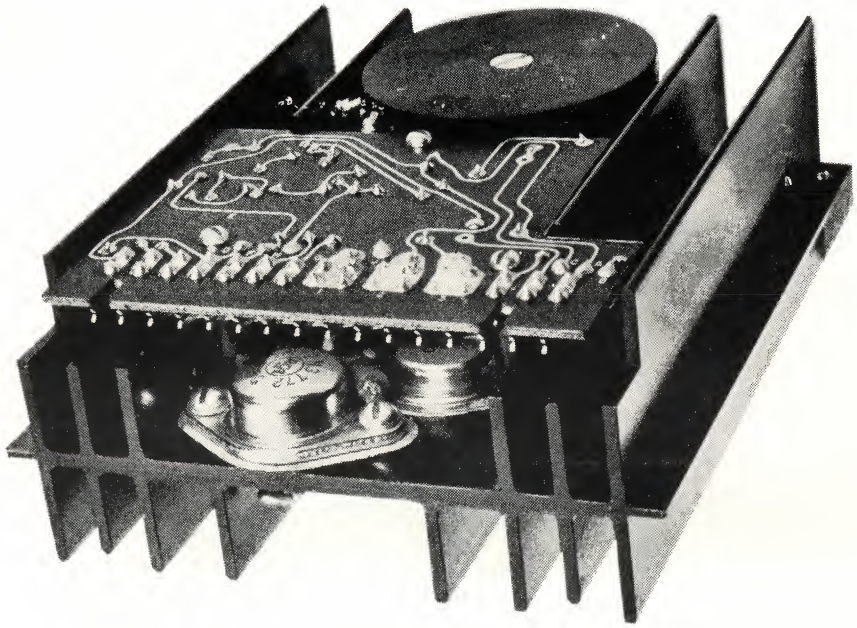

Figure 1 — OMNIMOD power control module.

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Omnimod Power Supply Concept

Most computers and other large electronic machines require custom, regulated, solid state power supplies because of the need for multivoltage outputs at different loads, special load characteristics, protection needs and packaging requirements. Many custom supplies employ more than one solid state regulation technique in order to satisfy all special load requirements.

Equipment design engineers generally dislike specifying a custom power supply because of the high initial cost for design, development and instructional manual preparation; and because the complexity of custom designs makes them difficult to understand, modify and maintain. Contemporary Electronics developed the OMNIMOD solid state power supply regulation concept in an effort to eliminate, as much as possible, these and other undesirable characteristics of custom power supplies.

BASIC OMNIMOD CONCEPT

The key component parts which make this concept feasible are the OMNIMOD power controller and the control amplifier. The power controller is a switching type regulator. It is a plug-in module 5 x 4-1/2 x 2 inches in size, and is assembled on a section of extruded aluminum heat sink (Figure 1). The control amplifier is a plug-in printed circuit board, 5 x 4-1/2 x 1/2 inches in size (Figure 2).

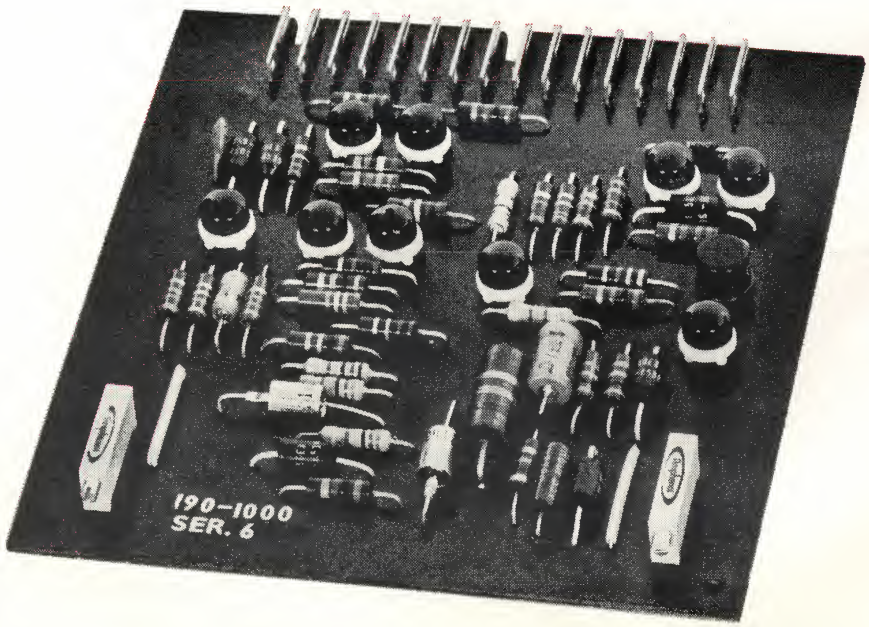

Figure 2 — OMNIMOD control amplifier.

The heart of the power control concept is a transistor switch. This switching regulator operates in a constant pulse width, variable repetition rate mode. The regulator transfers energy from a high voltage dc energy source to a storage capacitor across the load in pulses of energy. Therefore it will regulate over a wide range of output voltages without adjustment or modification. The maximum current output is automatically limited by the maximum allowed repetition rate of pulses.

Since there is no large output choke associated with the regulator circuit, the response time to full load steps is fast enough to keep output voltage within the regulation band. The control amplifier associated with this power control regulator is easily programmed for voltage sequencing, slow voltage build-up and remote adjust-

ment. In addition it has built-in overvoltage and/or undervoltage protection schemes.

The control amplifier senses the output voltage and commands the power controller to obtain the desired voltage at the load. Output voltage is determined by adjusting this amplifier. Any control amplifier can command up to four OMNIMOD power controllers when loads in the range of 7 - 25 amperes are to be supplied.

TYPICAL SYSTEM CONFIGURATION

A typical custom regulated power supply requirement for a computer has several voltage outputs, on and off sequencing of outputs, and is squeezed into a corner of a cabinet. A block diagram depicting how a typical supply would be assembled is shown in Figure 3. The required number of OMNIMOD power control modules is shown for each output. One control amplifier will control an indefinite number of power control modules. Electronic sequencing of voltages is accomplished with an additional plug-in printed circuit board.

Overvoltage protection which turns on an SCR crowbar across the output is built-in on the control amplifier cards. Provision for remote sense, remote voltage adjust and voltage adjust with temperature at some point such as a memory stack is also built-in on the control amplifier cards if needed.

The OMNIMOD power control modules and control amplifier are of comparable size. This means they can be arranged with standard aluminum electrolytic capacitor cans to achieve minimum wasted space. The power control modules can be distributed throughout the load to reduce power distribution problems.

PERFORMANCE CHARACTERISTICS

Typical efficiency of the OMNIMOD power control module is 90 per cent at full load, 30 volts dc output and nominal line voltage.

Regulation: line and load combined, 0.02 per cent or 40 mV, whichever is greater. Line frequency variation has no effect on regulation.

Temperature: full capacity at 50° C convection cooled.

Range: plus and minus output modules are available which are capable of supplying 2 - 60 volts dc at up to 10 amperes per OMNIMOD power control module.

Ripple amplitude: depends on amount of filtering provided.

MAIN ADVANTAGES

While the individual modules are complex solid state devices, a power supply assembled with OMNIMOD modules is easy to understand and requires little training of field personnel. For the most part, maintenance consists of plugging in a new interchangeable module for one that may have malfunctioned or been damaged. This keeps down-time and maintenance cost to a minimum.

OMNIMOD's electrical capabilities and packaging concept make it possible to build nearly any custom power supply using only one set of plug-in, interchangeable, compatible size modules.

Even the best designed machine may someday need additional power. OMNIMOD requires only an additional power control module; there is no need to redesign the entire power supply. For variable size machines, only the number of modules actually required need be plugged in.

If OMNIMOD is used to supply every voltage in every element of a data processing system, only a handful of modules need be stocked as spare parts.

OMNIMOD is suitable for supplying power to line printer hammers because of its no load/full load/no load step transient load change handling capability.

PRICE AND DELIVERY

OMNIMOD power control modules and control amplifiers are priced under $100. Charges for prototype custom power supplies using OMNIMOD units are low because there is little time needed to assemble the already designed modules into a package, and because many instruction manual sections are preprinted. Because OMNIMOD modules are produced in volume and inventoried, prototype custom power supplies can often be delivered with a four-week lead time.

For further information circle no. 20 on Reader Service Card.

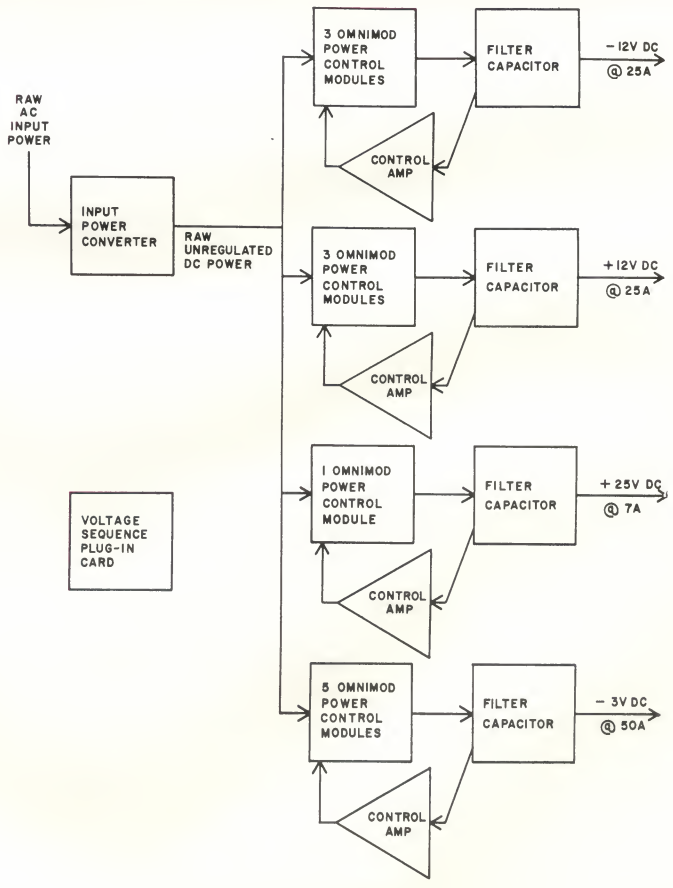

Figure 3 — Block diagram of typical power supply system arrangement of OMNIMOD modules.